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Implications of Biofuel Support Policies in Europe - A Quantitative Analysis in an Open Economy

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Outline

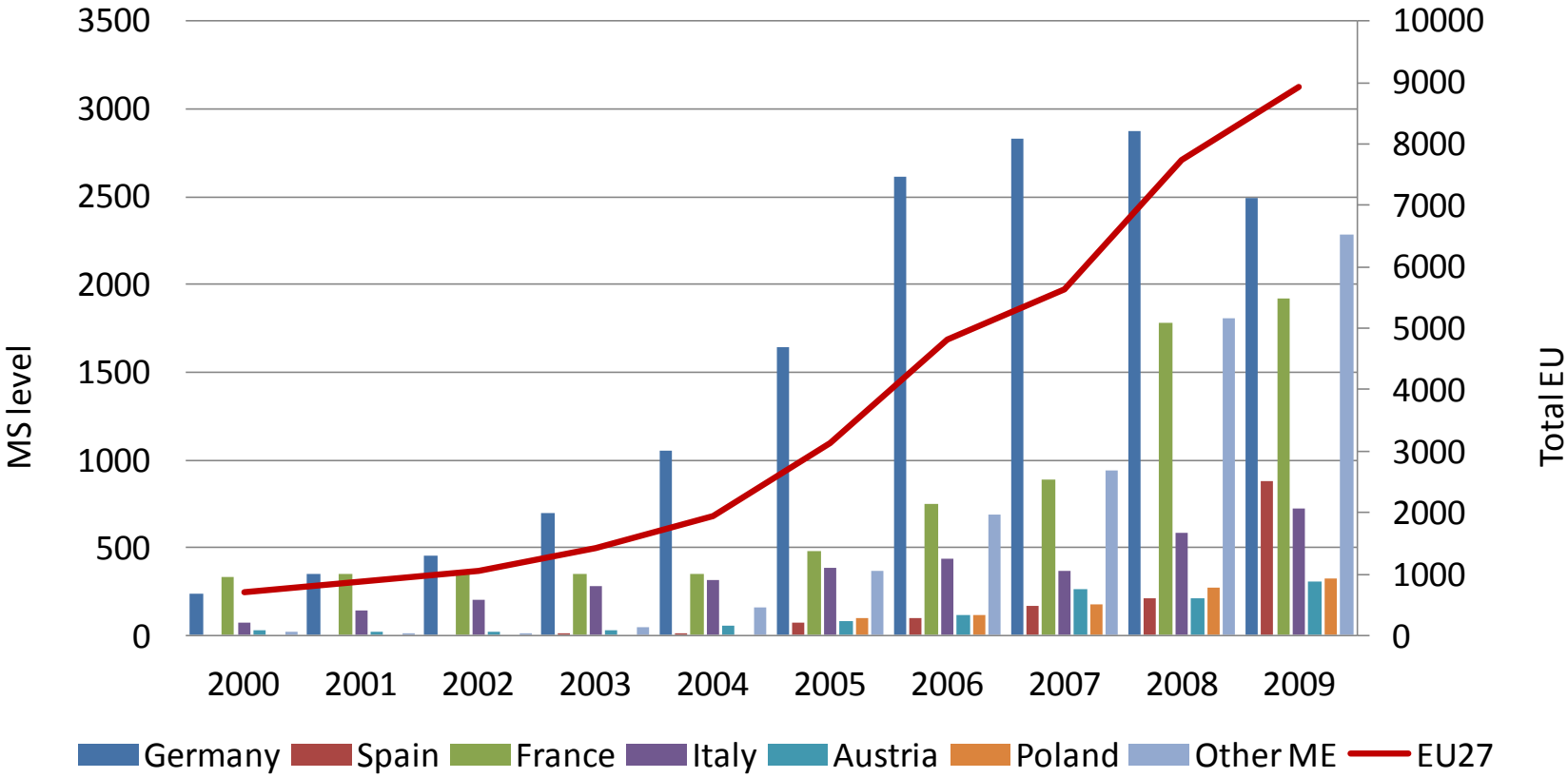
- EU biofuels support
- Biofuels modelling with CAPRI
- Scenario setting
- Main results
- Concluding remarks

EU biofuels support

Biofuels production and use have significantly grown during the last decade in the EU

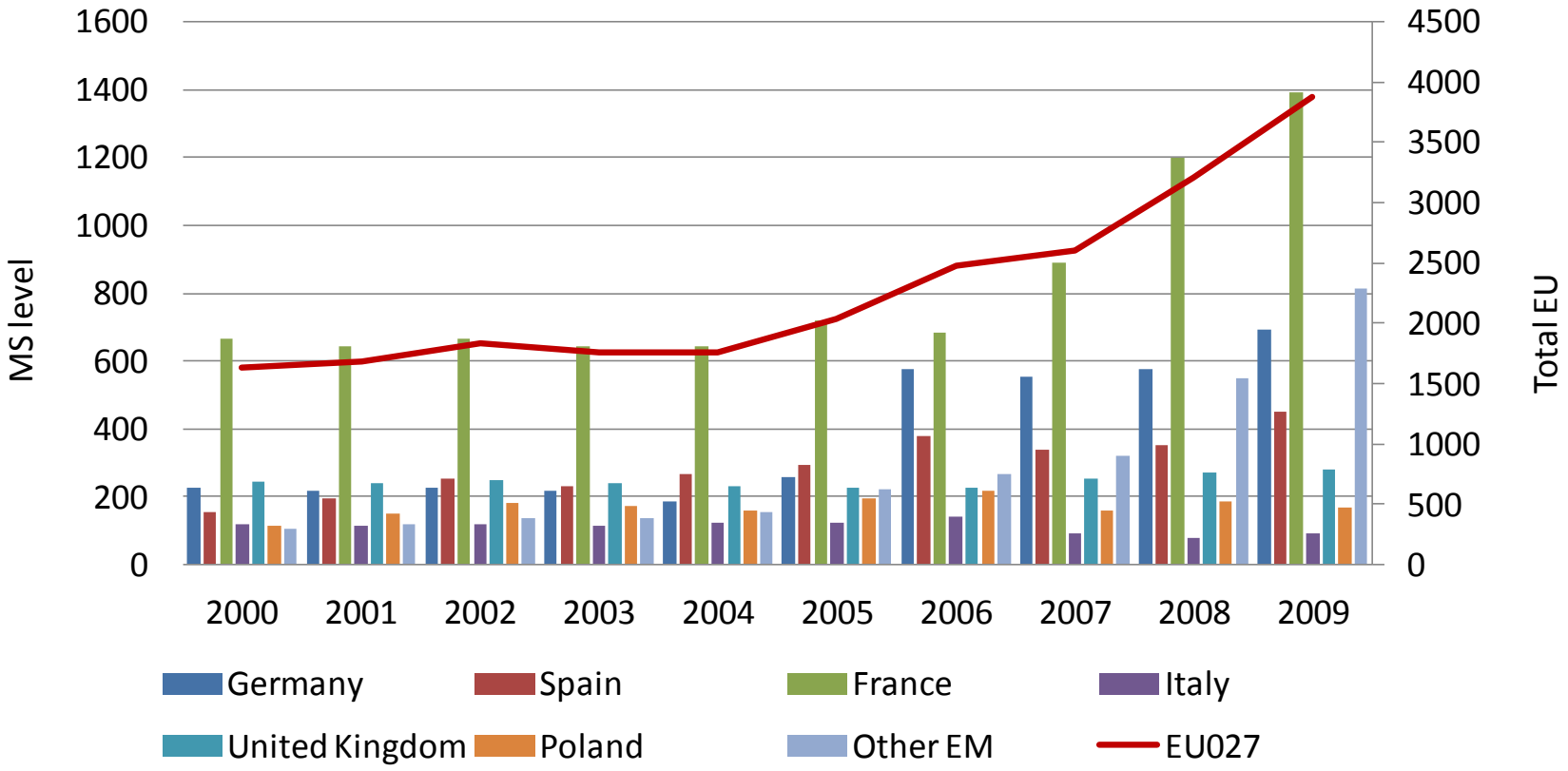
- Growth in biofuels production and use mainly driven by public support
- EU Renewable Energy Directive
  - Target of 10% renewable energy in total transport energy consumption by 2020
  - Implementation mechanisms at the MS level: quota obligations and tax exemptions for biofuels

EU Biodiesel Production (1000 t)



Source: CAPRI database (several raw sources)

EU Ethanol Production (1000 t)



Source: CAPRI database (several raw sources)

The development of the biofuel sector raises a number of concerns

- Contribution to reduce dependence from fossil fuels?
- Contribution to reduce GHG emissions?
- Contribution to maintain agricultural income?
- Food-fuel linkages, in particular competition for land and impacts on food prices

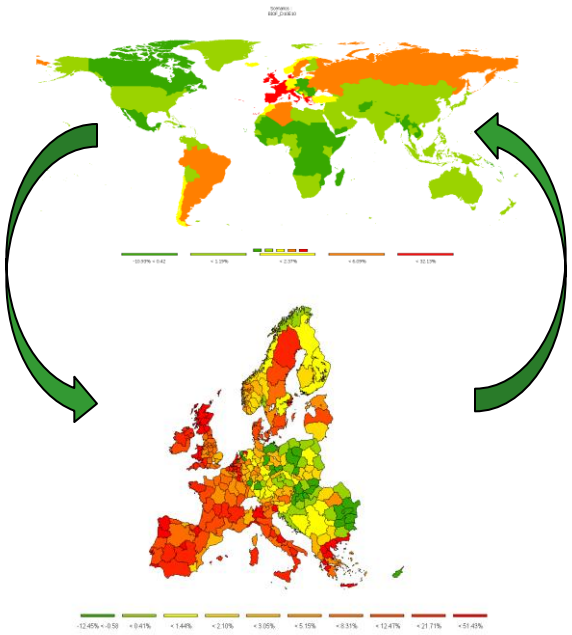
Research questions

- What are the impacts of the current EU biofuels strategy on global biofuel and agricultural markets?
- How these impacts will change if the EU eliminate tariffs for biofuels imports?
- How these impacts will change in case of a faster development path of second generation technologies?

Biofuels modelling with CAPRI

What is CAPRI?

- Spatial partial equilibrium model of agricultural commodity markets at the global level
- Two interlinked modules:



Global Spatial Multi-Commodity Model

77 countries in 40 trade blocks, 60 primary and secondary products, agricultural and trade policy measures

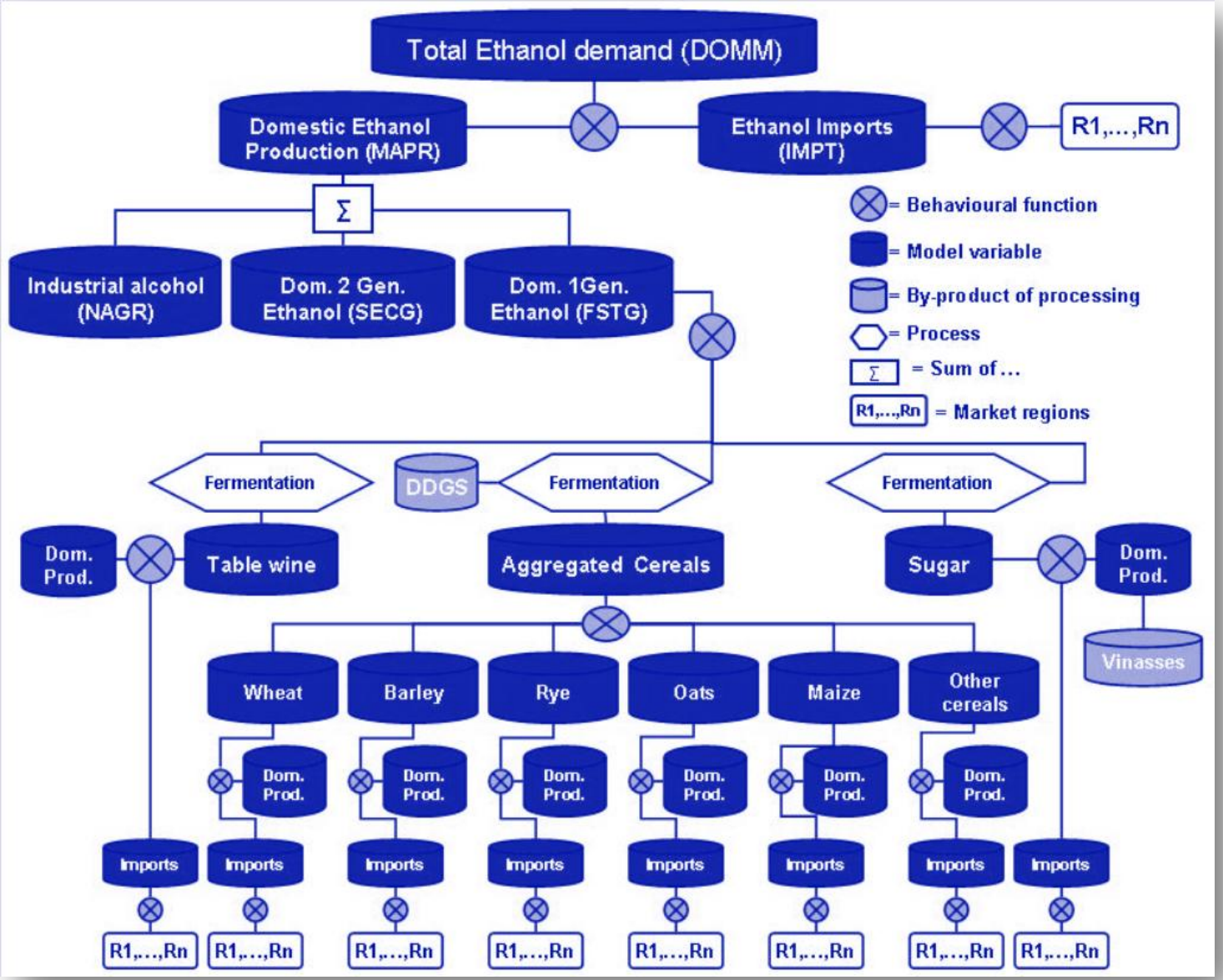
Regional Programming Models

280 regions for EU27+Norway +Western Balkans, detailed representation of farming decisions and CAP measures

Biofuels module

- Global representation of biofuels markets (ethanol and biodiesel)
- Endogenous supply, demand and trade flows for biofuels
- For domestic production, two technological pathways (first generation and second generation biofuels)

Ethanol markets



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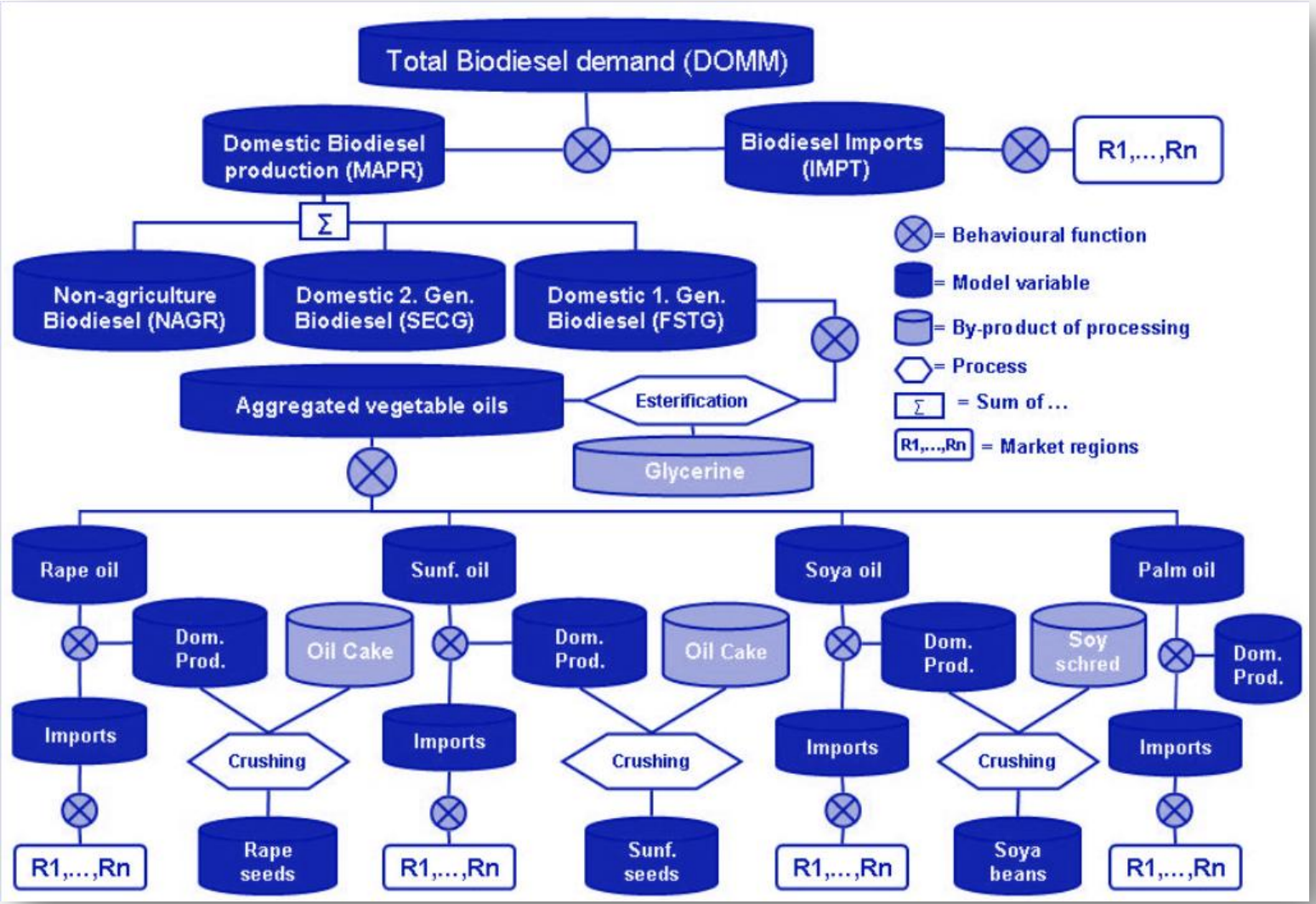
Biodiesel markets



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Scenario setting

Scenario setting

Baseline 2020

Agricultural market developments (in line with DG-AGRI baseline 2010)

EU biofuels support (mandates and tax exemptions)

Status quo for agricultural and trade policies

Counterfactual scenarios

1. No EU biofuel support (no mandates and no tax exemptions)

2. No EU biofuel tariffs (no EU tariffs for biofuel imports)

3. High second generation (faster development path for 2nd gen. technologies)

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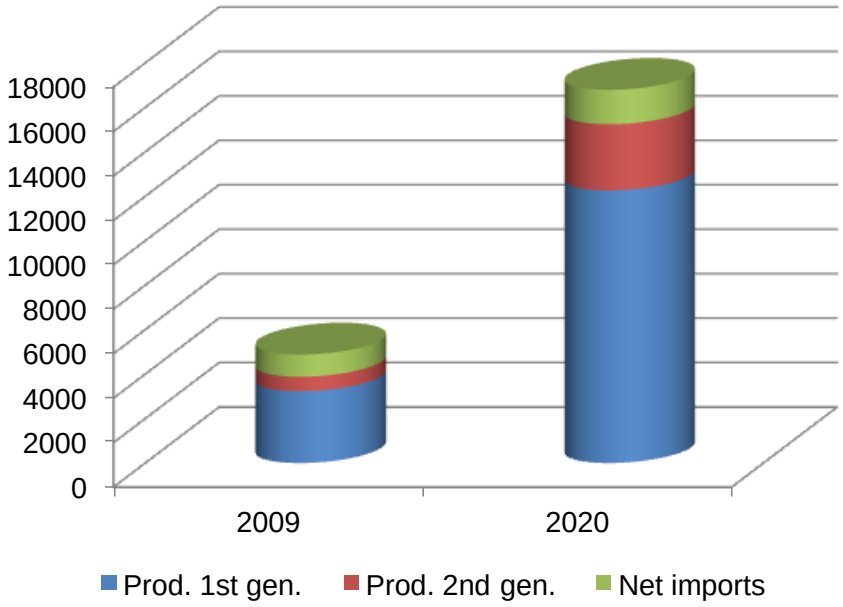
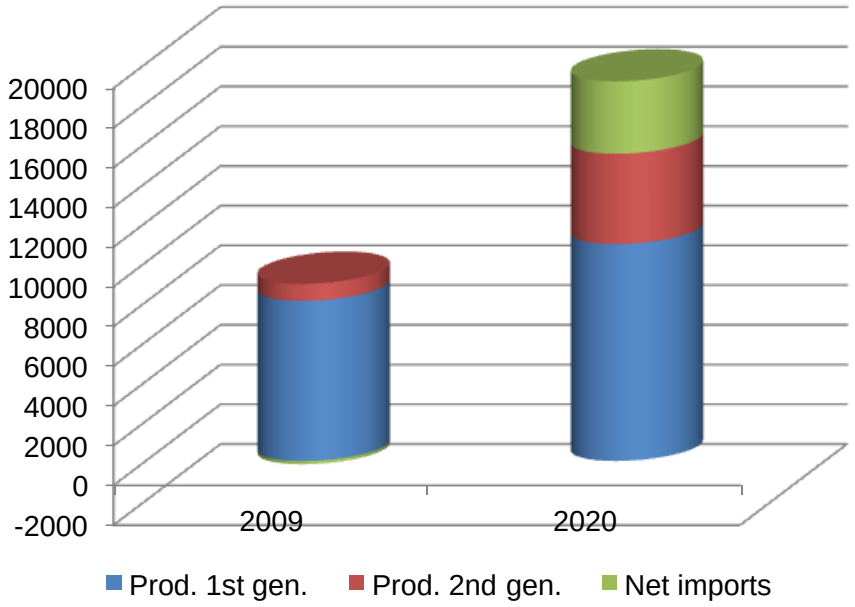
Scenario results

Baseline results compared to last year data (EU27)

Ethanol



Biodiesel



Baseline results (MS level)

	Ethanol (1000 t)			Biodiesel (1000 t)		
	Supply	Net Trade	Demand	Supply	Net Trade	Demand
European Union 27	15202	-981	16183	15480	-3633	19113
European Union 15	9784	-4108	13891	13724	-3660	17384
European Union 12	5418	3127	2292	1756	27	1730
Germany	1416	-2197	3614	4326	947	3380
France	2603	1485	1118	3617	570	3048
Spain	1333	107	1226	1075	-1971	3047
Italy	403	-1377	1780	1107	-1282	2389
United Kingdom	2469	-577	3046	1614	-399	2013
Czech Republic	718	349	369	315	28	287
Poland	1308	359	949	687	25	661
Romania	1341	1167	174	113	-24	137

Biofuels market balances in the EU

	Baseline (1000 t)		Percentage change compared to baseline					
			No biofuel support		No biofuel tariffs		High 2nd gen.	
	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel
Production	15245	15469	-73.8	-76.4	-11.7	-1.3	6.3	10.7
of which 1st gen.	12266	10921	-71.4	-68.3	-14.6	-1.8	-32.8	-23.2
of which 2nd gen.	2979	4549	-83.3	-95.9	0.0	0.0	167.3	92.3
Consumption	16183	19113	-75.7	-79.5	5.1	0.8	6.7	5.2
of which fuel use	14586	19113	-84.8	-79.5	5.6	0.8	7.2	5.2

	Baseline (Euros/ toe)		Percentage change compared to baseline					
			No biofuel support		No biofuel tariffs		High 2nd gen.	
	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel
Consumer price	1263	1308	7.8	-18.3	-11.1	-1.9	-11.7	-16.2

Biofuels market balances in the EU

	Baseline (1000 t)		Percentage change compared to baseline					
			No biofuel support		No biofuel tariffs		High 2nd gen.	
	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel
Imports	5903	5181	-82.7	-88.8	35.8	6.1	-9.0	-10.4
Exports	4361	19113	-27.4	-80.2	-9.0	-2.6	12.6	8.6

	Baseline		No biofuel support		No biofuel tariffs		High 2nd gen.	
	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel
Energy share (%)	10.1	8.0	1.5	1.6	10.5	8.1	10.6	8.5

First generation biofuels by feedstock (EU27)

	Baseline (1000 t)	Percentage change compared to baseline		
		No biofuel support	No biofuel tariffs	High 2nd generation
Ethanol from				
Wheat	3836	-75.8	-15.1	-35.6
Barley	1912	-72.3	-15.6	-32.8
Rye	854	-58.7	-13.1	-22.5
Oats	381	-74.3	-13.8	-34.6
Maize	2015	-76.4	-16.8	-35.7
Other Cereals	358	-71.3	-19.0	-32.1
Sugar	2840	-64.6	-11.6	-29.9
Biodiesel from				
Rape oil	7129	-61.0	-1.1	-17.3
Sunflower oil	1205	-78.1	-2.0	-26.3
Soy oil	1102	-77.3	-3.8	-27.7
Palm oil	1484	-89.1	-3.3	-45.9

Effects on EU crop production

		Percentage change compared to baseline		
	Baseline (1000 t)	No biofuel support	No biofuel tariffs	High 2nd generation
Soft wheat	141738	-2.3	-0.4	-1.0
Durum wheat	10264	-1.3	-0.2	-0.6
Barley	60964	-2.7	-0.5	-1.1
Rye and meslin	10436	-5.4	-1.4	-2.5
Oats	14371	-2.1	-0.3	-0.9
Grain maize	65586	-2.8	-0.5	-1.1
Sugar beet	107716	-5.2	-0.8	-2.2
Rape seed	24622	-5.1	-0.1	-2.1
Sunflower seed	7701	-2.3	0.1	-0.8
Soya seed	1178	0.1	0.1	0.0

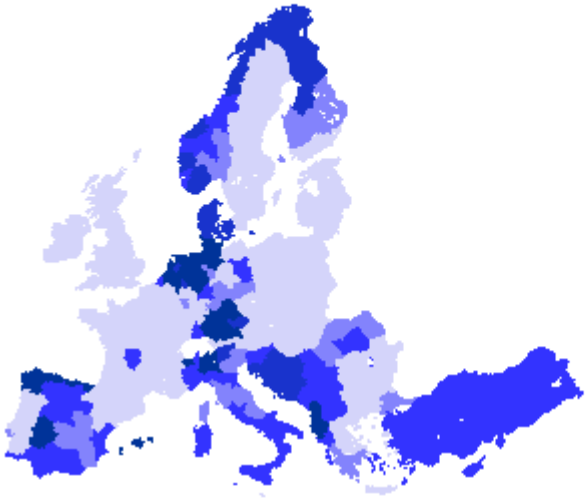
Effects on EU crop producer price

	Baseline (1000 t)	Percentage change compared to baseline		
		No biofuel support	No biofuel tariffs	High 2nd generation
Soft wheat	136.1	-4.0	-0.5	-1.5
Durum wheat	168.4	-2.1	-0.2	-0.8
Barley	125.8	-4.8	-0.7	-1.7
Rye and meslin	98.7	-11.2	-2.5	-4.1
Oats	119.2	-4.6	-0.7	-1.6
Grain maize	136.9	-4.2	-0.6	-1.5
Sugar beet	30.5	-15.4	-1.8	-6.7
Rape seed	290.0	-7.2	-0.2	-2.8
Sunflower seed	294.3	-4.6	0.1	-1.6
Soya seed	375.7	-0.8	0.1	-0.3

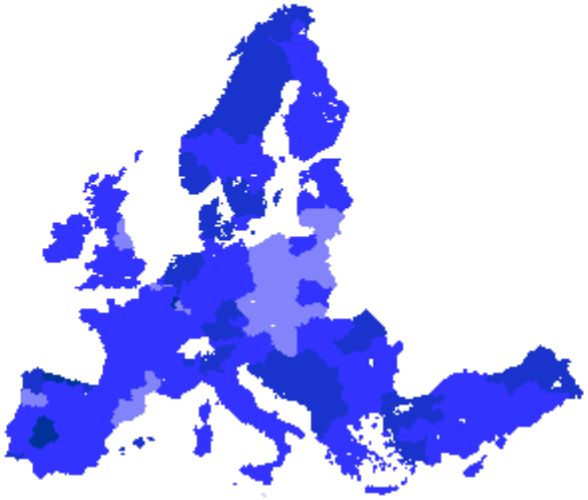
Effects on EU cropland allocation

		Percentage change compared to baseline		
	Baseline (1000 t)	No biofuel support	No biofuel tariffs	High 2nd generation
Soft wheat	22947.0	-1.0	-0.2	-0.5
Durum wheat	3120.0	-0.7	-0.1	-0.3
Barley	12845.7	-1.4	-0.3	-0.7
Rye and meslin	3024.0	-1.6	-0.5	-1.2
Oats	4251.2	-0.6	-0.1	-0.4
Grain maize	8591.8	-1.4	-0.2	-0.5
Sugar beet	1396.8	-4.9	-0.7	-2.0
Rape seed	6783.4	-3.5	0.0	-1.5
Sunflower seed	3544.3	-1.3	0.1	-0.5
Soya seed	462.9	0.2	0.1	0.0

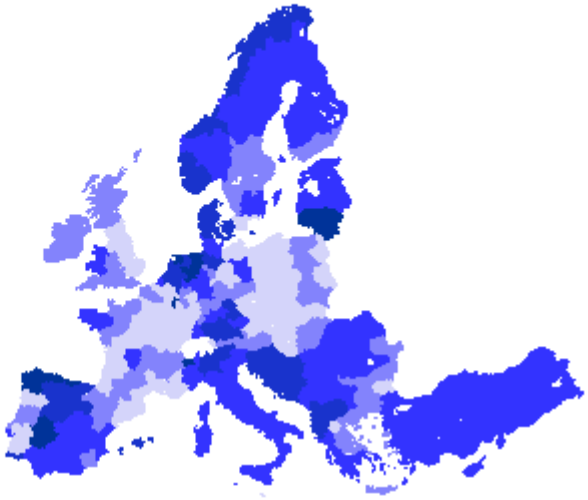
Regional effects on agricultural income (%change)



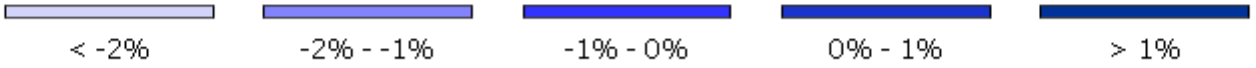
No EU biofuel support



No EU biofuel tariffs



High 2nd generation



Demand balance (maize)

		Percentage change compared to baseline		
	Baseline (1000 t)	No biofuel support	No biofuel tariffs	High 2nd generation
Total Demand	66133	-3.3	-0.6	-1.3
Human Consumption	5384	0.2	0.0	0.1
Feed	49922	3.5	1.1	2.1
Processing	3716	7.6	1.1	2.8
Biofuels processing	5554	-76.4	-16.8	-35.7
Other uses	1557	-1.2	-0.2	-0.5

Biofuels trade

		Percentage change compared to baseline		
	Baseline (1000 t)	No biofuel support	No biofuel tariffs	High 2nd generation
Ethanol				
Ukraine	633.7	-92.1	33.8	-19.0
USA	408.2	-95.8	46.1	-38.8
Brazil	474.4	-95.6	54.8	-37.7
Asian Tigers	392.7	-92.0	40.7	-26.3
Asian South East	611.4	-92.2	72.9	-26.6
Biodiesel				
USA	1462.5	-91.5	8.5	-18.4
Argentina	1281.6	-92.1	10.3	-18.0
Malaysia and Indonesia	371.7	-96.1	11.9	-19.1
Asian South East	52.5	-96.8	16.0	-25.9

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Global biofuels production

	Baseline (1000 t)		Percentage change compared to baseline					
			No biofuel support		No biofuel tariffs		High 2nd gen.	
	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel
EU	15245	15469	-73.8	-76.4	-11.7	-1.3	6.3	10.7
Non-EU	133439	16648	-1.4	-8.3	1.2	1.1	-0.4	-1.3
Russia	4067		0.2		-0.1		0.1	
Ukraine	2522		-9.3		4.2		-2.0	
USA	54668	3058	-0.9	-9.7	0.4	1.1	-0.3	-2.0
Canada	840	360	0.1	0.6	0.4	0.0	0.0	0.2
Brazil	57473	2251	-0.6	2.8	0.4	-0.1	-0.1	0.9
Argentina	459	3043	-0.3	-12.7	0.1	2.0	-0.1	-1.1
India	2225	2939	-0.9	0.1	0.8	0.0	-0.3	0.0
China	4340		-0.1		0.1		-0.1	
Malaysia and Ind.	455	1886	-1.2	-18.7	0.3	2.3	-0.2	-3.5
Asian Tigers	1091		-19.3		7.6		-5.5	
Asian South East	2177	1174	-8.1	-2.9	7.0	0.6	-2.4	-0.6
World	148684	32118	-8.8	-41.1	-0.1	0.0	0.3	4.5

Concluding remarks

- Biofuels production and use will remain mainly driven by public support
- Strong links of biofuels to agricultural markets
- Development of second generation technologies would ease food-fuel links

Thanks for your attention!

EU biofuels support

Applied tariffs	Fuel ethanol		Biodiesel	
	Specific €/toe	Ad valorem (%)	Specific €/toe	Ad valorem (%)
Norway	300	~	~	6.5
Turkey	~	3.0	~	16.3
EU15	300	~	~	6.5
EU10	300	~	~	6.5
Bulgaria and Romania	300	~	~	6.5
Rest of Europe	300	~	~	6.5
Russia, Belarus, Ukraine	~	15.2	~	13.7
USA	152	2.5	~	4.6
Canada	47	~	~	0.0
Brazil	48	20.0	~	4.6
India	~	34.2	~	99.8
Japan	~	15.2	~	13.7
LDC countries	~	23.8	~	16.3
ACP countries	~	~	~	10.0

	2020	
	Quota obligation	
	BIOD	BIOE
BL	6.0	6.0
DK	6.0	6.0
DE	9.0	8.7
AT	7.5	6.4
NL	6.7	2.9
FR	8.0	5.2
PT	5.5	2.8
ES	7.6	7.5
EL	5.2	3.5
IT	8.2	4.1
IR	6.0	2.9
FI	5.9	4.5
SE	6.0	6.0
UK	6.4	6.4
CZ	6.0	4.1
EE	4.1	2.8
HU	6.0	2.4
LT	5.1	4.2
LV	5.7	2.0
PL	6.0	3.4
SI	8.0	2.6
SK	5.9	3.0
CY	2.9	0.8
MT	1.1	0.6
BG	2.4	1.7
RO	2.3	1.6

Conversion rates

	tonnes/1000 l	litres/tonne	toe/tonne
Diesel	0.83	1205	1.01
Gasoline	0.72	1389	1.05
Biodiesel	0.88	1136	0.86
Ethanol	0.79	1266	0.64

Fuel consumption

	Baseline (1000 t)		Percentage change compared to baseline					
			No biofuel support		No biofuel tariffs		High 2nd gen.	
	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel
Use in the transport sector (1000 t)	79026.0	185973.9	9.5	7.0	-0.6	-0.1	-0.8	-0.5
Energy share in total fuel use (%)	89.9	92.0	9.6	7.0	-0.5	-0.1	-0.5	-0.5
Consumer price (Euro/ton)	1411.4	1087.1	0.0	0.1	0.0	0.0	0.0	0.0
Consumer taxes (Euro/Ton)	736.8	493.6	0.1	0.1	0.0	0.0	0.0	0.0

Trade blocks in CAPRI

- Asian Tigers (Hong Kong, Singapore, South Korea)
- Asian South East (Vietnam, Thailand, Brunei)

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Global biofuel production and recent trends

Table 2.1: World biofuel production in 2008, and recent trends

Country/ Region	Ethanol*		Biodiesel		Total	
	Mn litres 2008	% change 2005-2008	Mn litres 2008	% change 2005-2008	Mn litres 2008	% change 2005-2008
Brazil	22 239	46	1 089	155 471	23 328	53
Canada	1 083	167	205	388	1 288	188
China	3 964	15	114[1]	n.c.[2]	3 964[3]	15[3]
India	1 725	54	200	900	1 925	69
Indonesia	194	10	356	-[4]	550	211
Malaysia	64	-19	536	-[4]	600	659
USA	34 463	125	2 709	266	37 172	131
EU	5 022	71	8 064	123	13 086	100
Others	1 882	78	1 867	1 029	3 749	206
World	70 636	78	15 140[3]	230[3]	85 776[3]	93[3]

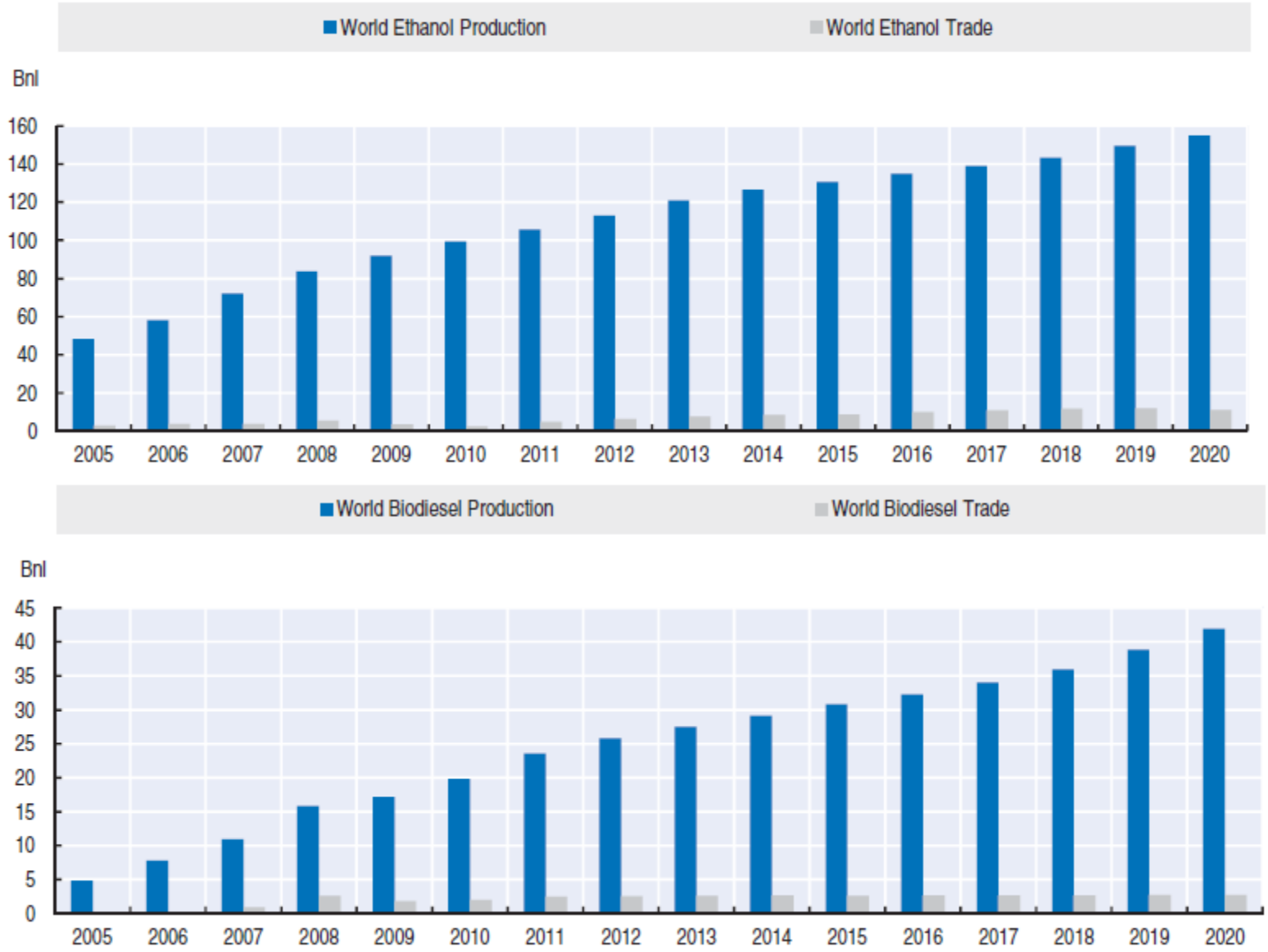
1. Production in 2007. 2. Not calculated. 3. Excludes China's biodiesel. 4. Production was zero in 2005.

**Includes ethanol used for purposes other than fuel.*

Source: AGLINK-COSIMO database.

Blanco et al. 2012

Previsiones de futuro



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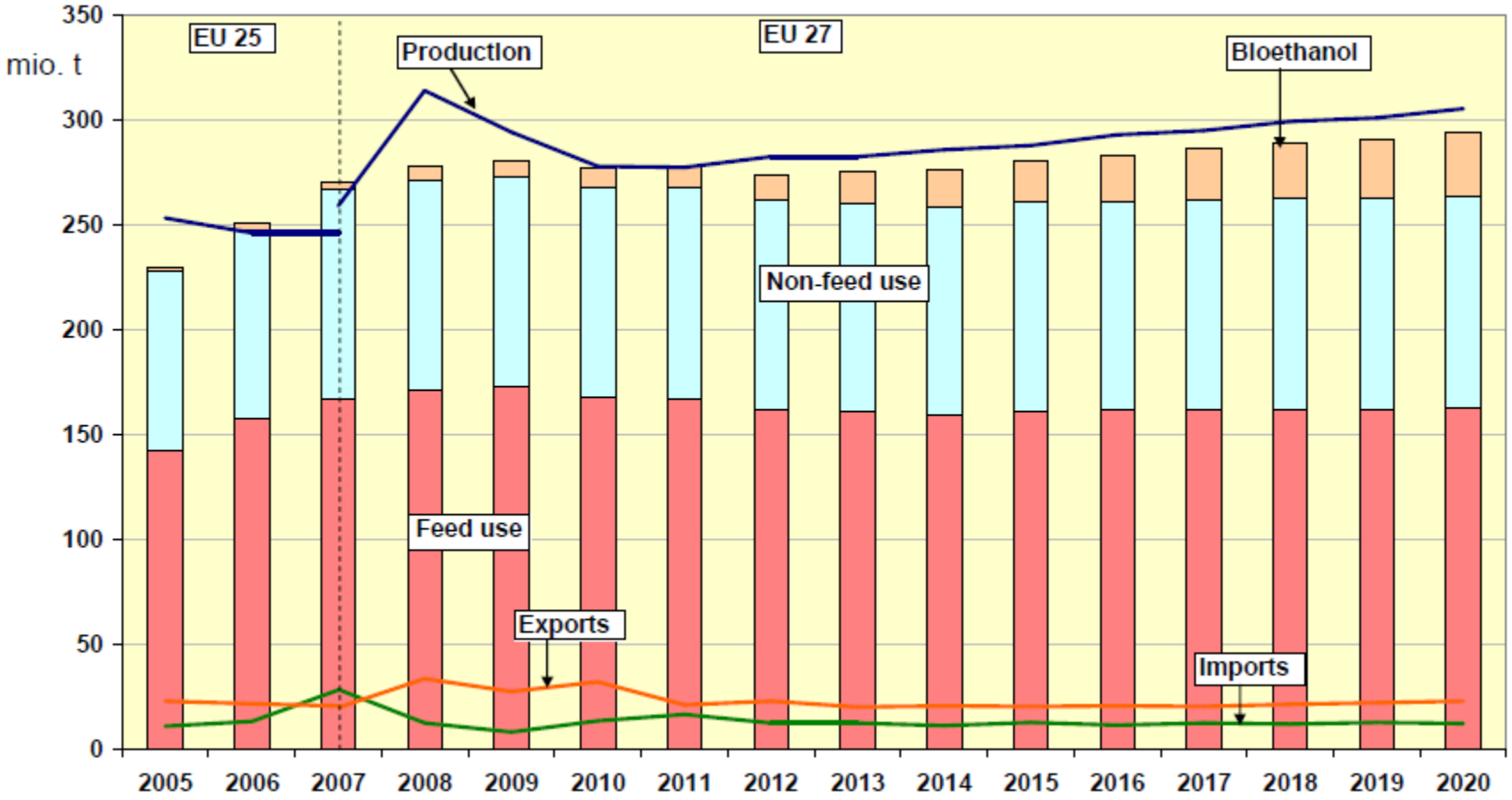
Source: OECD and FAO Secretariats.

StatLink http://dx.doi.org/10.1787/888932426486

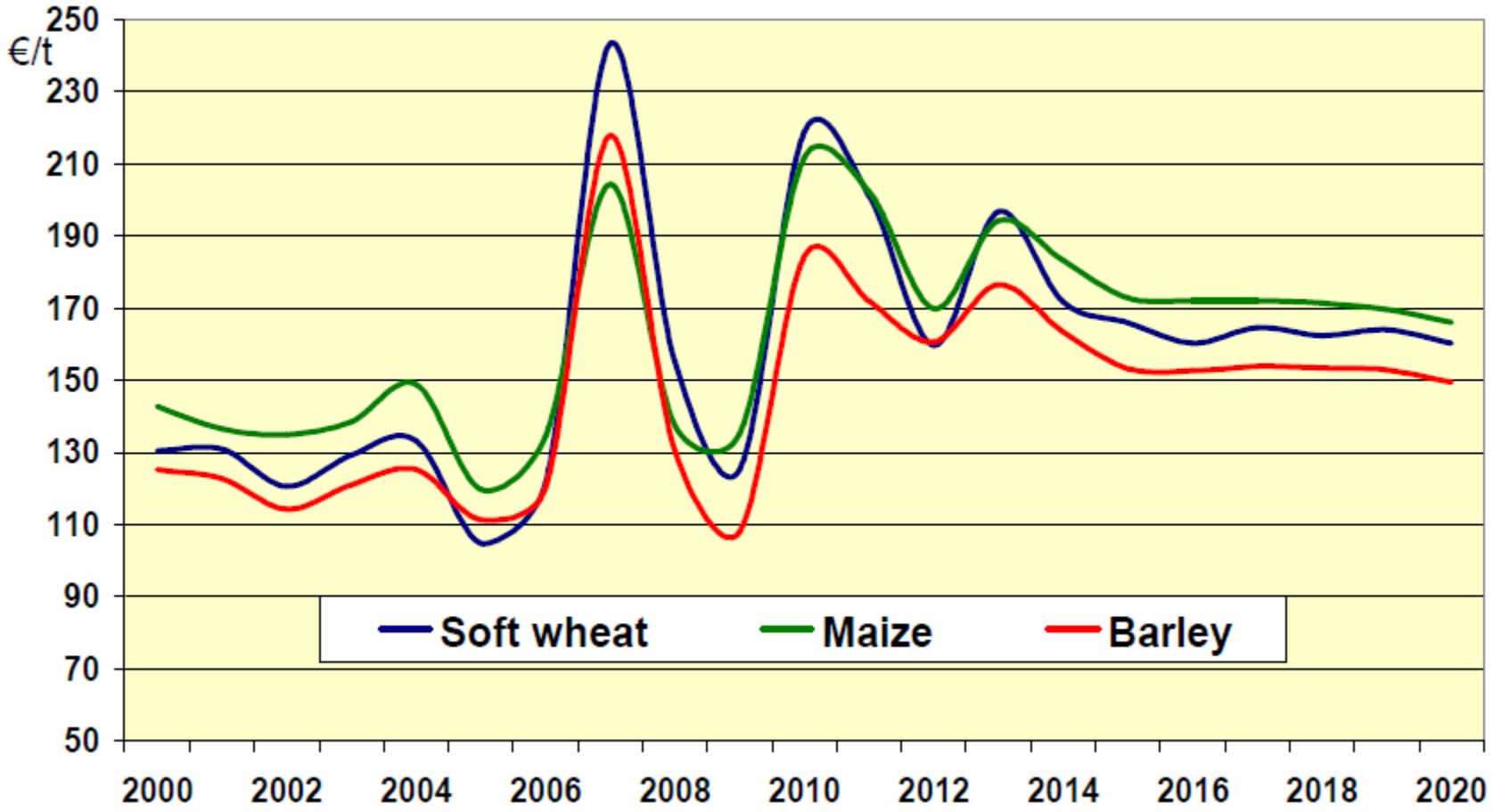
Increase in cereals production driven by biofuels feedstock demand



Fuente: Comisión Europea (2011)

Blanco et al. 2012

Crop prices will stay high



Fuente: Comisión Europea (2011)

Blanco et al. 2012

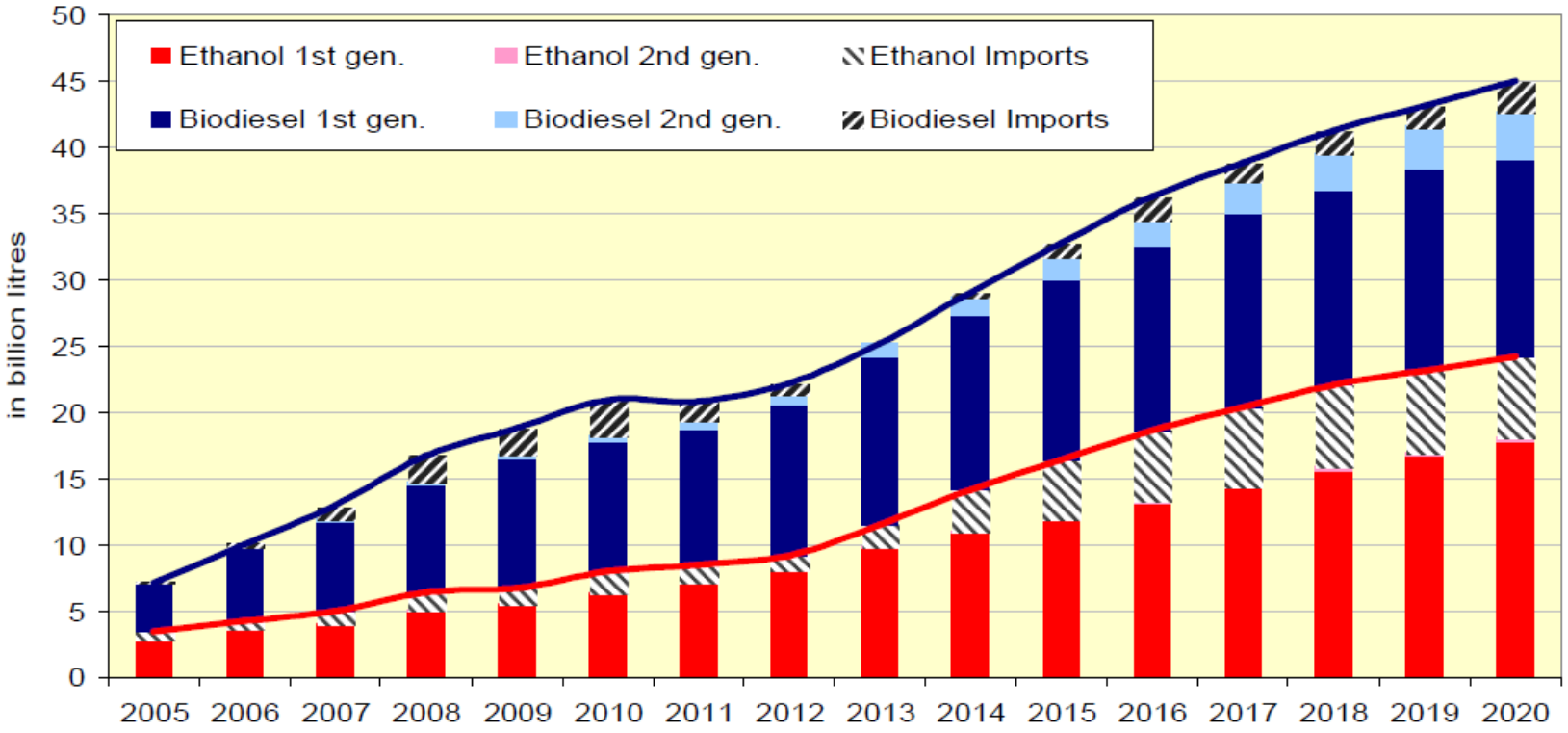
Production and consumption of biofuels will double in the EU in the next 10 years

Total biofuels balance sheet in the European Union, 2009-2020 (billion litres)

	2009	2010	2011	2012	2015	2020
Usable production	**15.8**	**16.7**	**18.1**	**20.3**	**27.3**	**36.7**
of which Ethanol	5.6	6.4	7.2	8.1	12.0	18.2
of which 2nd gen.	0.0	0.0	0.0	0.1	0.2	0.4
of which Biodiesel	10.2	10.3	10.9	12.2	15.3	18.5
of which 2nd gen.	0.4	0.5	0.7	0.9	1.7	3.6
Consumption	**18.8**	**21.0**	**20.8**	**22.2**	**32.8**	**45.0**
of which Ethanol	6.7	8.0	8.5	9.2	16.4	24.2
non fuel use of ethanol	2.3	2.5	2.5	2.5	2.5	2.5
of which Biodiesel	12.1	13.0	12.4	13.0	16.3	20.8
Net trade	**-3.0**	**-4.2**	**-2.7**	**-1.9**	**-5.5**	**-8.3**
of which Ethanol	-1.1	-1.6	-1.3	-1.1	-4.5	-6.1
of which Biodiesel	-1.9	-2.7	-1.5	-0.8	-1.0	-2.3
Biofuels energy share (% RED counting)	**4.1**	**4.6**	**4.5**	**4.8**	**7.0**	**10.0**
1st generation	3.9	4.2	4.1	4.3	6.1	8.0
2nd generation	0.1	0.2	0.2	0.2	0.5	1.0
Ethanol	5.0	5.3	5.0	5.2	6.3	8.0
Biodiesel	2.2	2.7	3.0	3.3	7.0	11.0
Diesel consumption (billion litres)	222.2	224.8	227.6	230.4	238.7	238.9
Gasoline consumption (billion litres)	138.0	136.1	135.6	135.1	133.6	132.1

Fuente: Comisión Europea (2011)

Important role of biofuels imports

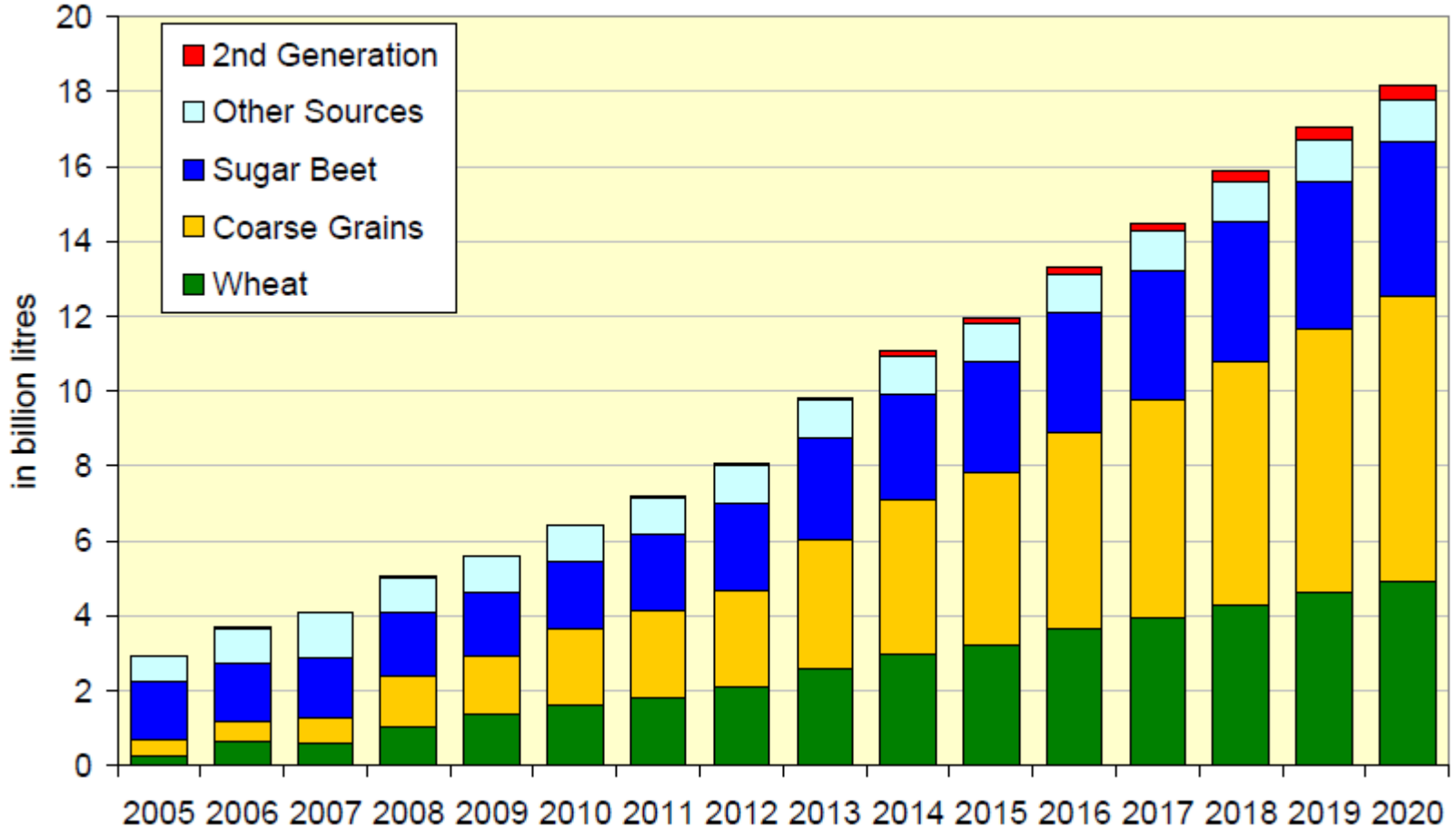


Note: Biodiesel 2nd generation is expected to be mostly produced from waste oils.

Fuente: Comisión Europea (2011)

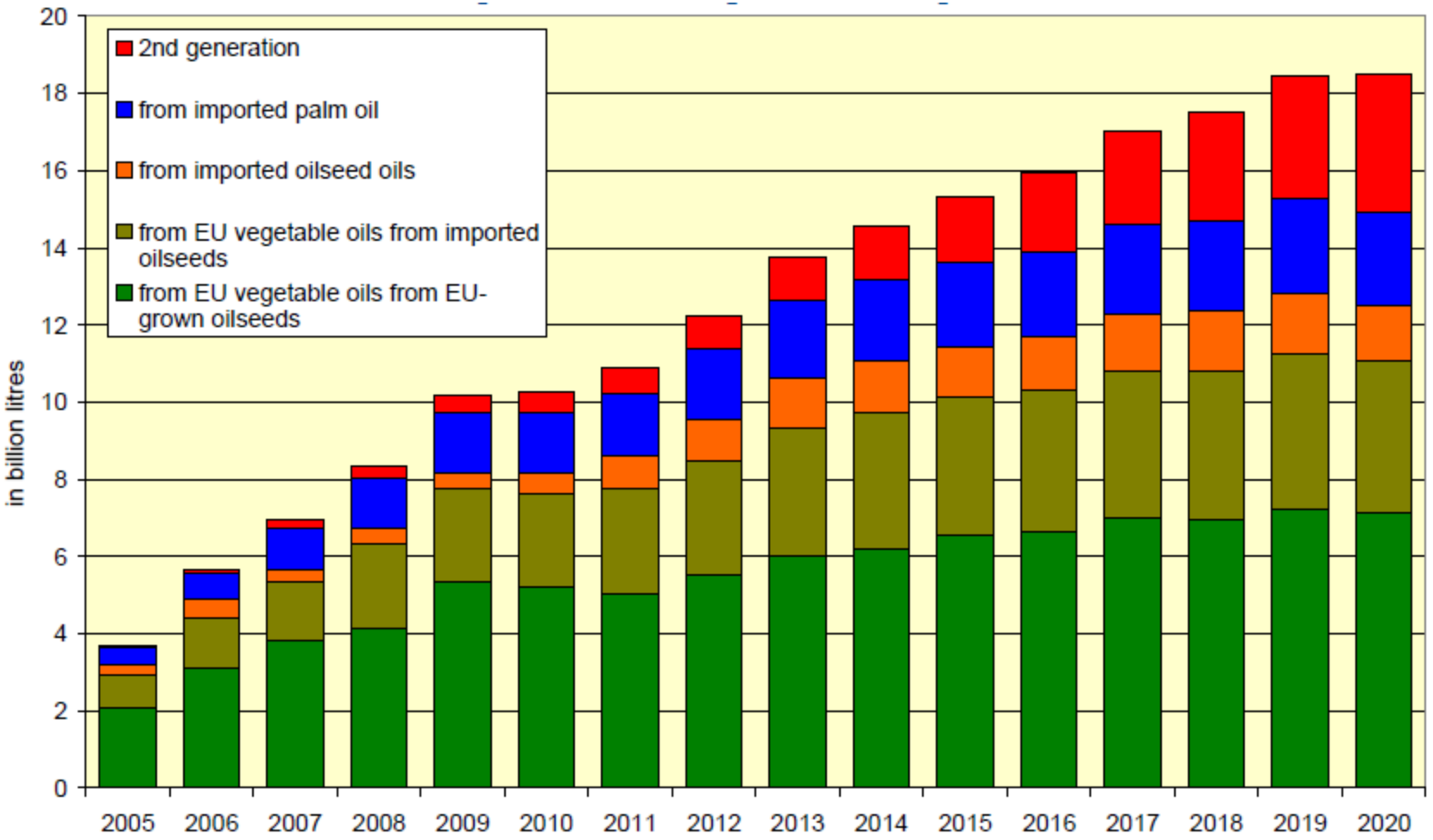
Blanco et al. 2012

Ethanol: increasing feedstock demand



Fuente: Comisión Europea (2011)

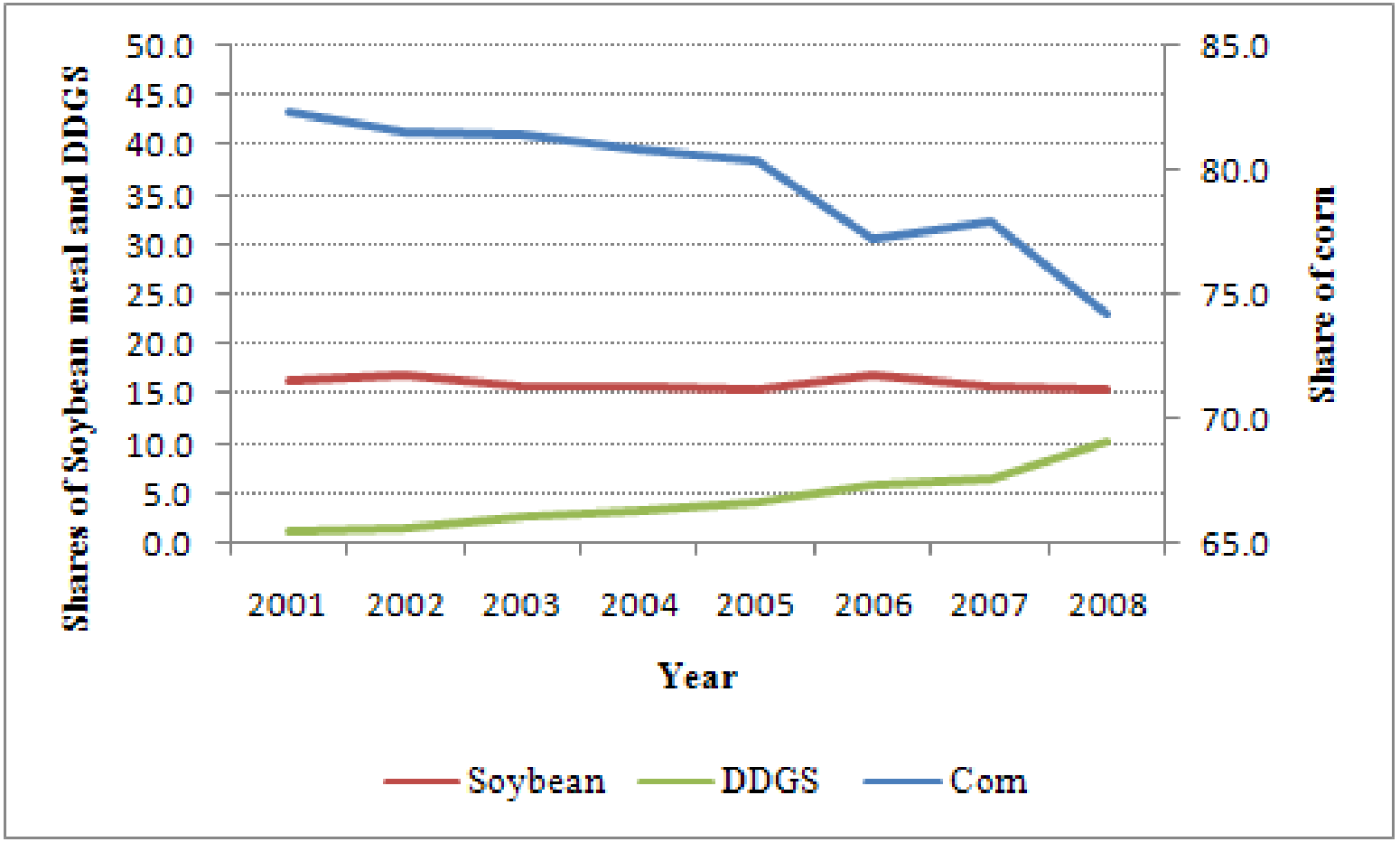
Biodiesel: dependence on imports



Fuente: Comisión Europea (2011)

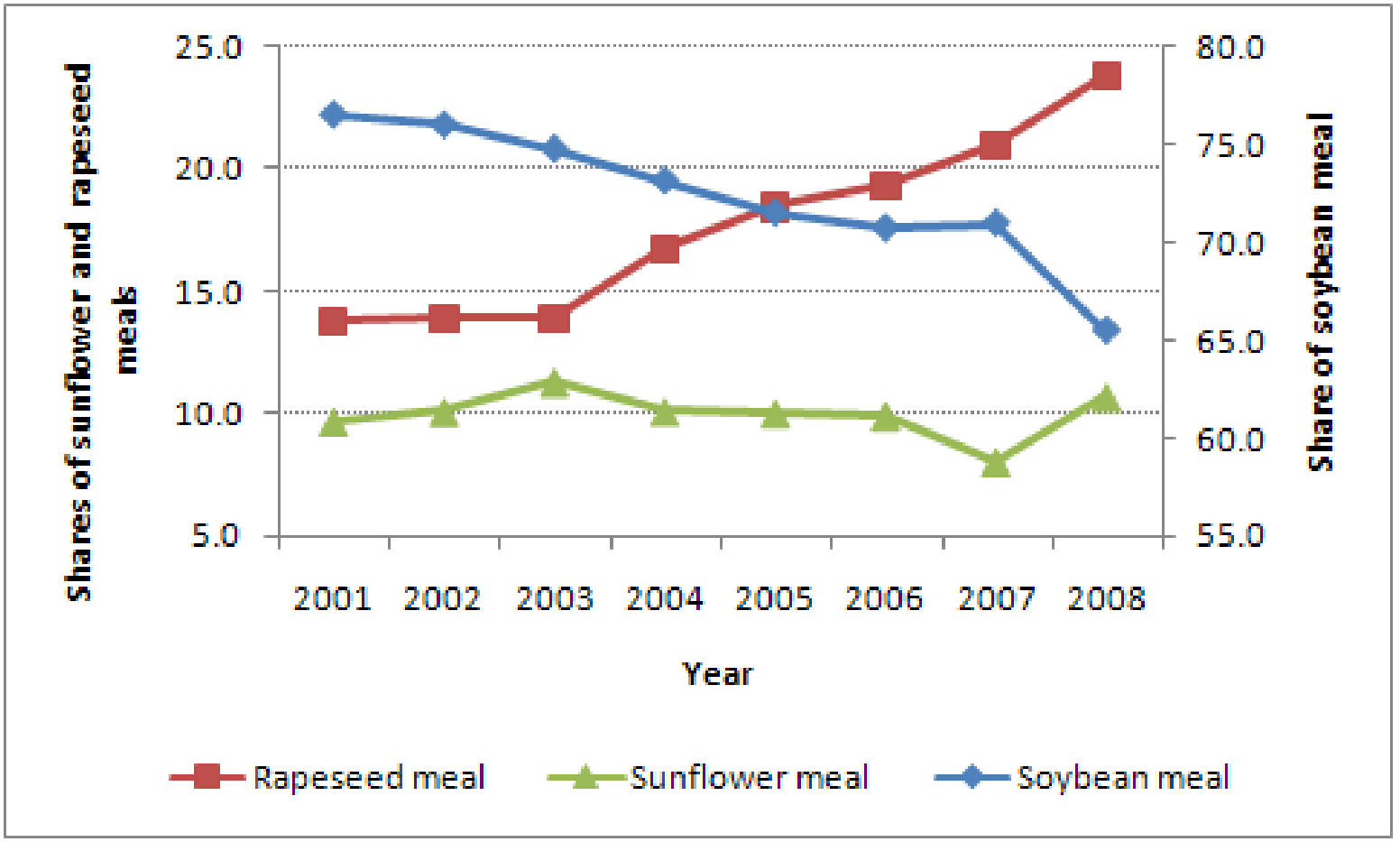
Blanco et al. 2012

US: uso creciente de DDGS en alimentación animal



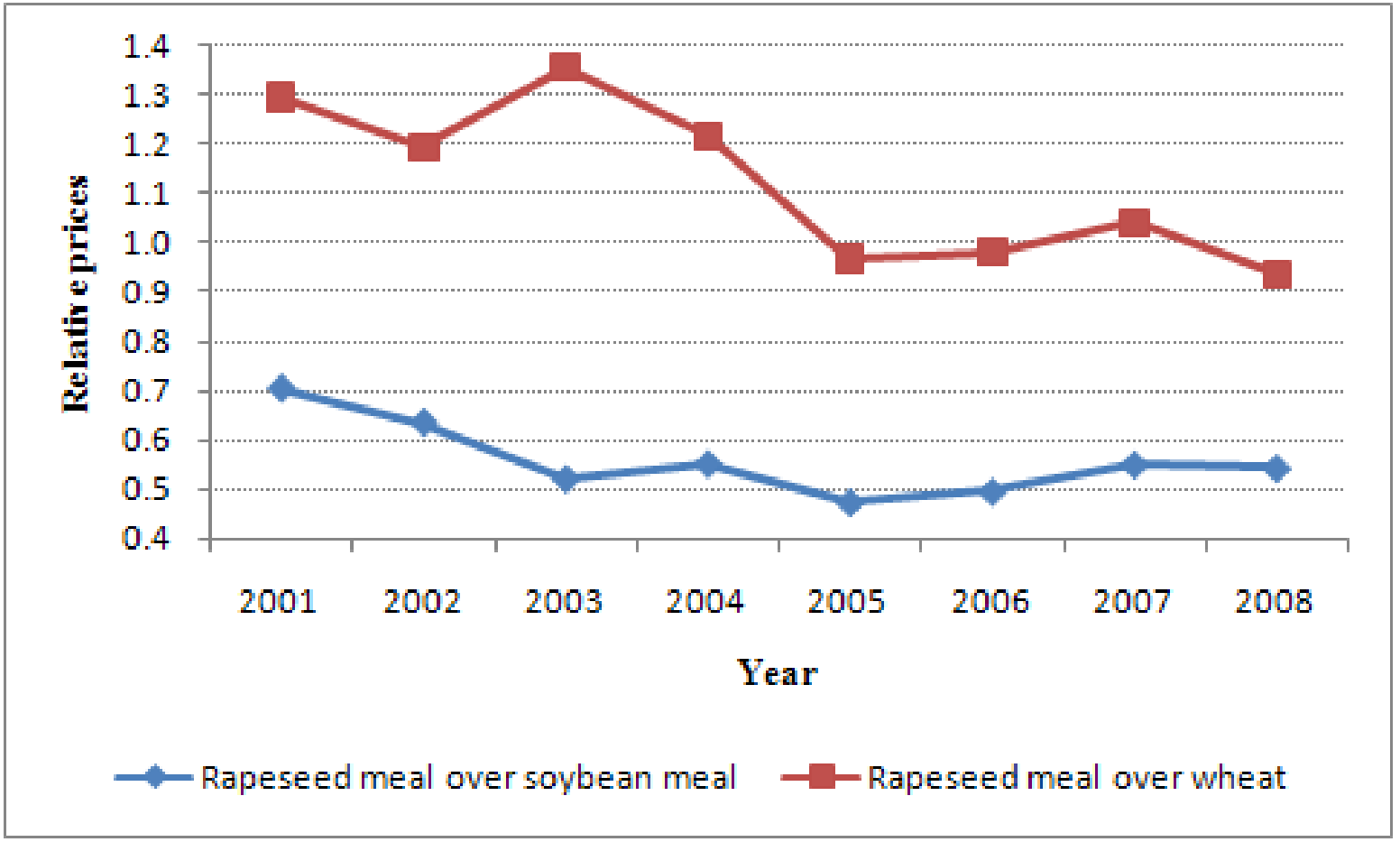
Fuente: Taheripour et al. 2010

UE: uso creciente de tortas de oleaginosas en alimentación animal



Fuente: Taheripour et al. 2010

UE: disminución del precio relativo de la torta de colza respecto a otras materias primas



Fuente: Taheripour et al. 2010

Tariffs

Table 3. Summary overview of US and EU subsidies, tariffs, and duties [€]

US Volumetric Excise Tax Credit	€/liter	€/tonne
(Fuel) Ethanol	0.102	129
Biodiesel (agricultural origin)	0.200	227
Biodiesel (waste oil)	0.100	114
EU average of maximum support levels within individual MS		
(Fuel) Ethanol	0.283	359
Biodiesel	0.228	259
US import tariffs and taxes		
Import duty undenatured ethanol (2.5% ad valorem) [b]	0.010	12
Import duty denatured ethanol (1.9% ad valorem) [b]	0.007	9
Import tax (un)denatured ethanol	0.108	137
Import duty biodiesel (4.6% ad valorem) [c]	0.029	33
EU import tariffs, ADD and CVD		
Import duty undenatured ethanol	0.192	243
Import duty denatured ethanol	0.102	129
Import duty biodiesel (6.5% ad valorem) [c]	0.040	46
Minimum anti-dumping duties on US biodiesel	0.060	69
Maximum anti-dumping duties on US biodiesel	0.174	198
Maximum countervailing duties on US biodiesel	0.209	237

a: own calculations based on EU MS reports (see http://ec.europa.eu/energy/renewables/biofuels/ms_reports_dir_2003_30_en.htm)
b: assumed international fuel ethanol price: 0.5136 US$/liter
c: assumed international biodiesel price: 0.8222 US$/liter

Blanco et al. 2012